ANSWERS Solubility of solids in solutions with a common ion

1) $n(Pb(NO_3)_2) = \dfrac{2.00\text{ g}}{331\text{ g mol}^{-1}}$
$= 6.04 \times 10^{-3}$ mol

$\therefore [Pb^{2+}] = 6.04 \times 10^{-3}$ mol / 0.500L
$= 1.21 \times 10^{-2}$ mol L^{-1}

$Q = (1.21 \times 10^{-2}) \times (0.440)^2$
$= 2.34 \times 10^{-3}$

As $Q > K_s$, **a precipitate will form.**

2) $Fe(OH)_3(s) \rightleftarrows Fe^{3+}(aq) + 3OH^-(aq)$
Ion Product (IP) = $[Fe^{3+}] [OH^-]_3$
At pH 7, $[OH^-] = 1 \times 10^{-7}$ mol L^{-1}
IP = $[1.05 \times 10^{-4}] [1 \times 10^{-7}]3 = 1.05 \times 10^{-25}$
Since IP > Ks, $Fe(OH)_3$ **will form a precipitate**

3) $Ag_2CrO_4(s) \rightleftharpoons 2Ag^+(aq) + CrO_4^{2-}(aq)$

Less silver chromate dissolves.
Silver chromate is in equilibrium. More chromate ions shift this to the left.

4) $n(Pb(NO_3)_2) = \dfrac{1.00\text{ g}}{331\text{ g mol}^{-1}} = 3.02 \times 10^{-3}$ mol

If the lead nitrate is dissolved in the 500 mL, then $[Pb^{2+}] = 6.04 \times 10^{-3}$ mol L^{-1}
$Q_s = [Pb^{2+}] [Cl^-]^2 = 6.04 \times 10^{-3} \times (0.440)^2 = 1.17 \times 10^{-3}$
As Q_s (1.17×10^{-3}) exceeds K_s (1.60×10^{-5}), **a precipitate will form.**

5) The added Cl^- reduces the solubility of the NaCl. For the saturated solution:

$NaCl(s) \rightarrow Na^+(aq) + Cl^-(aq)$. The addition of Cl^- causes the equilibrium to favour the reactants and hence a **precipitate will begin to form.**

6) Ionic product $= [Ca^{2+}][F^-]^2$
and $[F^-] = 5 \times 10^{-5}$
Ionic product
$= (2 \times 10^{-4}) \rightleftarrows (5 \times 10^{-5})^2$
$= 5 \times 10^{-13}$
IP< K_s
So **no precipitate will form.**